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The Kentucky Warbler

*"To sift the
sparkling from the
dull, and the true*



*from the false, is
the aim of
every Ornithologist."*

Volume XXI

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Number 2

THE SONG-PRODUCTION MECHANISM OF BIRDS

By ARCH E. COLE, Department of Anatomy, University of
Louisville School of Medicine

(A paper read before the Beckham Bird Club, December 14, 1943).

One of the more remarkable characteristics of Mother Nature is her frugality. She never throws away anything for which there may be a use; and if there is no immediate use, she keeps it anyway. Her attic is full of old junk, as is evidenced by our appendix, our ear muscles; and the remnants of five or six pairs of caudal muscles to move a tail that was discarded a million or so years ago. But if she decides to change the furnace so that it can utilize a different fuel supply or to put in a new air-conditioning system, she never has to go out after new materials, but using the old, she ingeniously fashions the new structure. And so clever is her workmanship that it takes extremely careful observation to detect the origin of the second-hand materials that she has used.

When animals migrated from water to land, a new type of respiratory system was necessary. The gills that operated in a water medium were inadequate for air respiration. This new system was produced merely by pushing out the ventral wall of the pharynx to form a tube, dividing it, and enlarging the ends into a pair of sac-like lungs. No new materials were required. To give support to the tubes leading to the lungs—they needed support to keep them open so that air could have free access to the vascular lungs where the waste carbon dioxide was to be exchanged for new oxygen—she used the old supporting structure of the gills, the bronchial arches, from which she formed the cartilages of the larynx—thyroid, cricoid, and arytenoid—and the cartilaginous rings of the trachea and bronchi. From the old muscles of the larynx which formerly had moved the gills she fashioned the new musculature of the larynx, which could raise or lower it and which could open or close the entrance into the pharynx.

This rather simple breathing apparatus was about all she gave to the Amphibians, and to the Reptiles which developed from them.

Back in the Jurassic Period Mother Nature got very ambitious and began experimenting with her newly-formed reptiles. Making changes here and there, discarding many unsatisfactory and impractical patterns, she finally emerged with two new models of land-living, air-breathing vertebrates, the one the Mammals, the other the Birds.

While the respiratory systems of these two new groups were essentially the same as that of their progenitors, the Reptiles, Nature improved each, making them more elaborate and more efficient, for both the Birds and the Mammals were warm-blooded and so needed greater amounts of oxygen. Then, too, she gave to each a rather elaborate sound-making apparatus, cleverly building the voice-box into the respiratory system so that the currents of incoming or outgoing air could be utilized as the motive power. And again she did not go out after new materials, but using those at hand, she accomplished her purpose.

The two voice-boxes, that of the Birds and that of the Mammals, are entirely different, built on different principles and located in different parts of the respiratory tract. One is not the outgrowth or modification of the other. The only things they have in common are that both produce sound and both are specializations of the respiratory tract. This is one of the many differences between birds and mammals which have led students to conclude that, from an evolutionary standpoint, there is no linear relationship between the two groups, but that each is the result of parallel development from a common ancestor, the early Reptile. Birds and mammals are, then, cousins one to the other, both being progeny of Old Grandfather Reptile.

To understand the avian voice-box, called the syrinx, and to appreciate the way it operates to produce the melodious song of its possessor, it might be well to review briefly the structure and functioning of our own voice-producing apparatus.

Our voice-box, as is that of all mammals, is located in the larynx at the upper end of the respiratory tube. The larynx is a rather roomy compartment, supported by the thyroid, cricoid, and arytenoid cartilages and lined with a ciliated mucoepithelium. The cartilages are provided with a series of intrinsic muscles (five or six pairs) which run from one cartilage to another and which, by their contraction, can change the shape of the larynx. Additional extrinsic muscles connect the larynx to the surrounding hard parts and thus are capable of changing its position by raising or depressing it.

Stretched across the larynx from front to back are a pair of thin folds, the vocal cords. These folds, being attached to movable cartilages of the larynx, may be abducted, that is, separated, to allow an uninterrupted passageway for incoming or outgoing air; or they may be adducted, or brought together, in the path of the air current, in which position they may be set in vibration. The cords may be tightened or tensed by a set of muscles, which is comparable to tuning a violin; the greater the tension, the higher the pitch. In addition, the attached margins of the cords are provided with a very complicated muscle which is capable of damping out varying amounts of the vibrating edge of the cord, which of course changes the length of the vibrating element and so changes the pitch. This is comparable to fretting the strings of a violin.

Thus we see the mammalian larynx supplied with muscles which are capable of (1) swinging the cords in or out of position, (2) increasing or decreasing the tension of the whole cord, and (3) increasing or decreasing the length of the vibrating portion of the cord. Volume depends upon the intensity of the blast of air forced out of the lungs and past the cords, by the contraction of the muscles of expiration. Tonal qualities are produced by accessory mechanisms such as the lips, the teeth, and the tongue; by changing the shape

of the pharyngeal and oral cavities; and by the use of all the spaces connected with the pharynx, the mouth, and the nasal cavities as resonating chambers.

The voice-box of the bird is built on an entirely different principle. It is called the *syrinx*, which means "a pipe." Huxley called it the "Pipe of Pan." It is located, not in the upper end of the

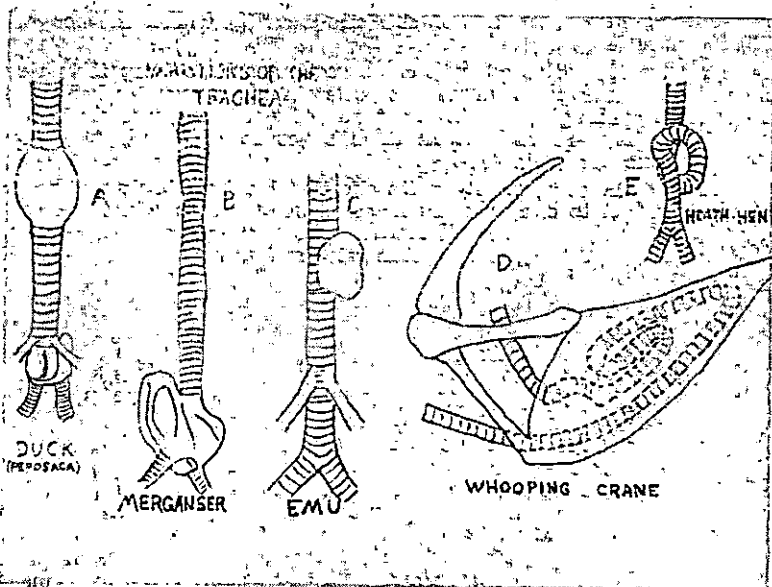


Figure I. TRACHEAL VARIATIONS. A—the tracheal balloon of a duck (*Peposaca*); B—the tympanic labyrinth of a male merganser; C—the tracheal diverticulum of a female Emu; D—the elongated trachea of a Whooping Crane coiled in a cavity in the sternum; E—the coiled trachea of the Heath Hen. (Redrawn after Stresemann, 1937).

trachea as is the larynx, but at the lower end, where the trachea divides into two bronchial tubes.

The larynx of birds is very simple. The cartilages are much reduced; they are not provided with muscles to move them; there are no vocal folds. It has nothing to do with sound production except acting as a part of the passageway to the outside. In fact, a rooster, with its trachea cut below the larynx and led through the wound to the outside, can crow just as well as he did before the operation. The only difference in his vocal accomplishments is one of quality, due to the loss of the resonating function of the upper part of the respiratory tract.

From the larynx, the trachea extends along the neck to a point under protection of the shoulder girdle, where it bifurcates into the bronchial tubes. In its course it usually lies to the right side of

the vertebral column. Being in front of the esophagus, the crop pushes it to one side. The trachea, of course, must be as long as the distended neck of the bird. In some instances it is much longer; thus in the Heath Hen it is coiled upon itself in the neck region (Fig. 1E); in the Guinea Fowl it is coiled in a cup-shaped depression in the head of the clavicle in some of the geese and in the Bird of Paradise it invades a pouch between the skin and the breast muscle, or between the breast muscle and the sternum; in the Whooping Crane several coils of the trachea extend into a cavity within the body of the sternum (Fig. 1D).

The trachea is circular in cross section, and to keep it in this shape its wall is provided with a series of rings, usually bony but sometimes cartilaginous. Unlike those of mammals, the rings are complete; they are beveled on their edges so that they may slip over one another (Fig. 4A).

The bronchi are usually quite short and extend backward more or less parallel to one another; in some instances they are actually fused together. Like the trachea they are supplied with bony rings. As they enter the lung, they divide into smaller bronchi.

The lungs are not lobed as in the mammals. They lie in the dorsal part of the body cavity and are bound closely to the dorsal body wall. Only their ventral surfaces are covered with pleura and are free to expand. There is no diaphragm.

Not all the bronchi terminate in the lung. Some of the smaller ones pass right through the lung and end in thin-walled sacs which permeate all regions of the body except the head. These air sacs are unique in birds. They invade the body cavity and surround the viscera; they send prolongations out into the larger bones; the interclavicular sac extends into the neck region and completely surrounds the trachea and bronchi. These sacs, of course, lighten the body; they help hold the wings in an extended position; they are a reservoir for air, greatly increasing the ventilating capacity of the body and allowing for an uninterrupted exchange of gases during flight. They are absolutely necessary for sound production by the syrinx.

At the bifurcation of the trachea into the bronchi the bony rings are greatly modified. This is the region of the syrinx. The lower tracheal rings are broader than others and are partially fused together, forming a more or less rigid cavity, the **tympanum** (Fig. 2). The lowermost tracheal ring, or in some birds extra syringeal rings below the tympanum, fuse ventrally to form a heavy bar, the **pessalus**, which projects backward in the middle of the trachea, dividing it into right and left halves. The pessalus thus forms the medial boundaries of the upper ends of both bronchi. The upper bronchial rings, one to four, are really only half rings, being incomplete on their medial side. The other bronchial rings are complete. The space between the pessalus above, the first complete bronchial ring below, and the inner ends of the half rings is filled in with a thin membrane, the **internal tympaniform membrane**, which is one of the vibrating elements of the syrinx (Fig. 3). Laterally, between the first bronchial ring and the lowest tracheal ring (or more frequently in singing birds between the first and second, or second and third bronchial rings) there is a wider space than usual. This space is covered with a second vibrating element of the syrinx, the **external tympaniform membrane**.

Between the bony rings the walls of the trachea and bronchi are

formed by a dense connective tissue membrane which is lined on its inner surface with a ciliated mucoepithelium. But the specialized tympaniform membranes are thin, translucent, non-ciliated, and have very little connective tissue fibers in them. They are lined internally with a squamous epithelium and are covered externally by the epithelium of the air sac which surrounds the syrinx. In singing birds

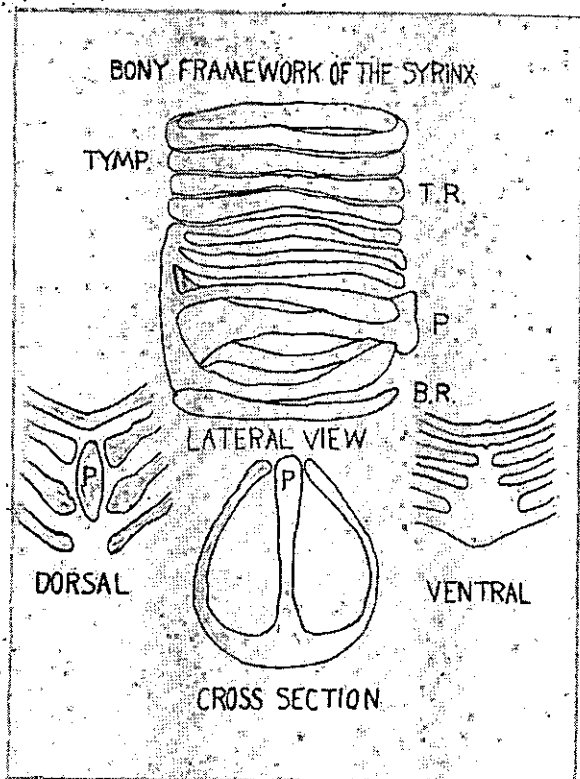


Figure 2. THE BONY FRAME-WORK OF THE SYRINX OF THE DOMESTIC CHICKEN. B. R., bronchial rings; P., pessalus; T. R., tracheal rings; TYMP., tympanum. (Modified after Myers, 1917).

there is a thickened pad of tissue, called the *labium*, which lies opposite each tympaniform membrane (Fig. 3). These pads or cushions are on the lateral border of the pessalus opposite the external tympaniform membranes, and on the outer wall of each bronchus opposite the internal membranes. They serve to constrict the air passage at the level of the vibrating membranes and so convert each bronchus into a narrow slit.

These tympaniform membranes are the elements which are set

in vibration by a blast of air expelled from the lungs. However, blowing through a syrinx which has been removed from a dead bird will produce no sound. The reason is that the membranes instead of vibrating are merely ballooned out by the increased internal pressure. But if the syrinx be surrounded by a chamber which can be inflated at the same time that air is blown through the syrinx, then a sound will be produced. This is the part that is played by the air sacs in sound production. Connected as they are with the lungs, as air is forced out of the lungs, it not only passes out through the syrinx but at the same time it is forced into the air sacs, thus increasing their internal pressure. The interclavicular air sac completely surrounds the syrinx; thus the pressures on the two sides of the vibrating membranes are approximately equal. As the current of air rushes through the slit of the syrinx, it has a tendency to push the membranes outward, but they are pushed back again by the pressure in the air sac and so they are set in vibration.

These, then, are the essential qualifications of the syrinx as a voice-box: (1) a membrane located in a constricted part of the air passage which is capable of vibrating and (2) a mechanism which will maintain pressure on the outside of the membrane while a blast of air passes through the passage. The membrane is thus put in vibration, and a sound is produced. With the addition of a mechanism which will change the shape and tension of the vibrating membrane, changes in pitch are brought about. I know of no musical instrument which is built on this principle.

The syrinx which has just been described is of the tracheo-bronchial type and is a sort of composite affair; but it is more or less characteristic of the Oscine or singing birds. There are so many variations of the apparatus in the thousands of species of birds that it would be impossible to describe each type; in fact, the anatomical details are known for only a few.

Certain birds have their vibrating membranes wholly in the trachea, as is the case in *Thamnophilus*, a neo-tropical ant shrike. This is the tracheal type of syrinx. Others, like *Crotophaga*, the anis, and *Steatornis*, a South American goatsucker, have a wholly bronchial syrinx. The vibrating membranes are on the lateral side of the bronchi just before they enter the lungs.

In the parrot the internal tympaniform membranes are ossified, and the pessalus is absent. In the swan the bronchi are fused together, and the internal tympaniform membranes are absent. In these cases the external tympaniform membranes assume the whole function of sound production. In the Ostrich and in the American vulture there is no syrinx at all.

Most of the variations of the syrinx, just cited, are found in the non-singing birds. However, the mere presence of a syrinx with well-developed tympaniform membranes does not make a good songster. The chicken has a fine syrinx, but it does not rate very highly as a song bird. The trouble with the chicken is that its syrinx lacks intrinsic muscles which could change the general contour and the tension of the vibrating membranes. Consequently, its song, or whatever you choose to call it, is devoid of pitch variation; it is monotonous, all in the same tone. The variations which you hear in the "cock-a-doodle-doo" are confined almost entirely to changes in quality and volume.

Of the muscles which act on the respiratory tract of birds, the

most obvious are the tracheosternalis and the mylohoïd. The former pulls the trachea forward; the latter backward. They are thus antagonistic in their action. They are concerned mainly with anchoring the trachea and/or changing its length. This latter function may be instrumental in producing tonal changes, but it has little to do with song. There are also tracheal muscles which extend from

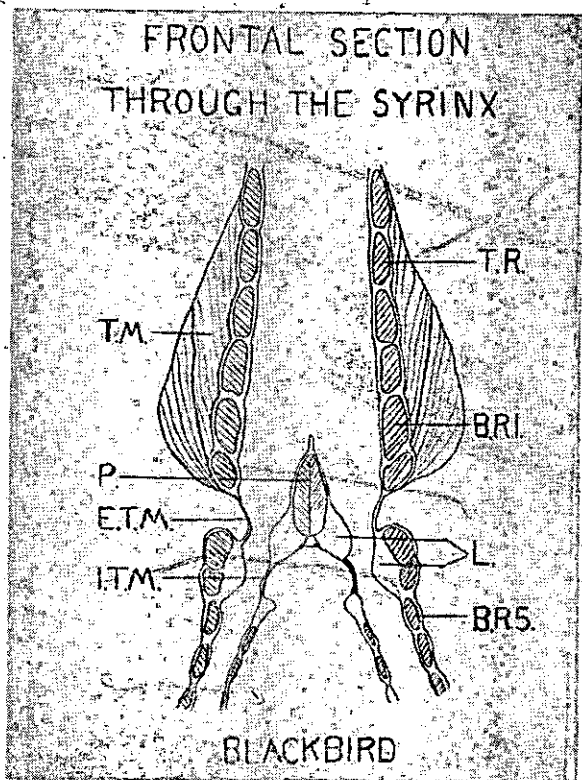


Figure 3. FRONTAL SECTION THROUGH THE SYRINX OF A MALE BLACKBIRD. B. R. 1., first bronchial ring; B. R. 5., fifth bronchial ring; E. T. M., external tympaniform membrane; I. T. M., internal tympaniform membrane; L, superior labium, inferior labium; P, pessalus; T. M., tracheal muscles, T. R., tracheal rings. (Modified after Hacker, 1898).

one bony ring to another, having no skeletal attachments. These also serve to change the length of the trachea.

But the really important musculature are the groups of muscles associated with the syrinx. These muscles attach the various bony rings of the syringeal region and extend from part to part, some straight, others obliquely. They are thus capable of placing the

vibrating membranes in all degrees of tension, and in varying relationships to their elastic cushions, by separating, or pulling together, or rotating the rings to which the membranes are attached. Space does not allow a detailed description of these muscles. Suffice it to say that in the singing birds the following paired muscles have been described: the *dorsalis longus*, the *dorsalis brevis*, the *dorsalis obliquus*, and the *dorsalis ventralis*, all of which are tracheobronchial and are thus located externally to a deeper group, the *syngaeus dorsalis*, the *syngaeus ventralis*, and the *syngaeus ventrolateralis* (Fig. 4B).

With all this muscular array to change the vibrating membranes, it is little wonder that its possessor is such a songster. However, even here the proverbial Ethiopian lurks, for not all birds with such imposing mechanical equipment are good singers. The intricacy of the song is in the muscular control of the syrinx. The cousin of the Crow, the European Rook, which Thompson called "that corvine croaker," has never learned how to manipulate his high-powered syrinx. He is as I am with a saxophone: I just make a noise. He is like many of us: the mere possession of a larynx with perfectly good vocal cords and muscles to move and adjust them does not make us accomplished singers. There is no correlation between the complexity of the syringeal mechanism and the intricacy of the song. The good singers, besides having a good mechanism, have inherited a definite pattern in their nervous systems which enables them to play instinctively on their "Pipes of Pan."

The tremendous number of variations of the other parts of the avian respiratory tract which have their effect on changing the tonal qualities of the notes produced almost beggar description. Just a few can be mentioned here. The tracheal length varies greatly, as does also the ability to change the length by using the extrinsic muscles attached to it. Thus, other things being equal, the longer the trachea, the lower the pitch. The eagle can change its tracheal length between 142mm. and 241mm. Birds with long necks, and thus long tracheae, generally have lower-pitched notes. The fact that the trachea is coiled in some birds has little or no influence on the pitch; it is the same as if it were straight.

There are many variations in the diameter and the rigidity of the trachea (Figs. 1A, 1B, 1C). Besides the tympanum, which has already been mentioned and which acts as a rigid resonating chamber as well as a rigid attachment for syringeal muscles, there is the tympanic labyrinth, found in certain of the ducks, especially the males. This is a large, irregular, bony outpocketing in the syringeal region (usually on the left side), through which the sound must pass; sharp, angular turns in the pathway in the labyrinth gives rise to sudden changes in the quality of the tones, thus producing noise, which is so characteristic of the male duck calls.

In many species of duck the middle section of the trachea is ballooned out to form a resonating chamber (Fig. 1A). In certain male ducks some of the tracheal rings are incomplete dorsally, and a tracheal-sac is formed. In the Emu a similar sac appears on the ventral side of the trachea of the female during the mating season (Fig. 1C), which makes her call louder by increasing the resonance.

In the penguins the trachea is divided into two compartments by a cranial extension of the pessalus. In the Pinnated Grouse the

expanded air sacs in the neck act as resonating chambers which modify the sound produced.

One might think that because the syrinx of singing birds is double, one in each bronchus, two tones could be produced at the same time. This is apparently impossible. The two elements work together just as do our two vocal cords.

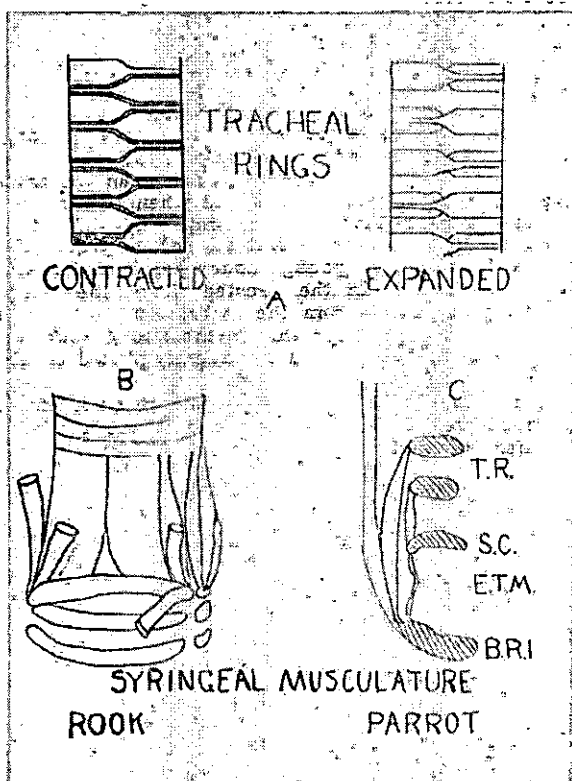


Figure 4. A. TRACHEAL RINGS, CONTRACTED AND EXPANDED. (From Coues, 1927, after Macgillivray). B. THE SYRINXIAL MUSCULATURE OF THE ROOK; the syrinxial muscles are intact, the more external tracheobronchial muscles have been cut. (Redrawn from Stresemann, 1937, after HACKER). C. DIAGRAMMATIC FRONTAL SECTION OF ONE SIDE OF THE SYRINX OF A PARROT, showing the attachment of the unique syrinxial muscles. B. R. I., first bronchial ring; E. T. M., external tympaniform membrane; S. C., semilunar cartilage; T. R., tracheal rings.

Sexual dimorphism in the voice mechanism is not found in all birds. Some observers have thought that the syrinxial musculature

was better developed in the male, but this is questionable. Certainly it is not true in such birds as the Cardinals, the grosbeaks, the Purple Finches, and the wrens, where the females are singers equally as good as the males.

In a number of species where the syringeal musculature is not very specialized, sex differences in the calls may be due to differences in the length of the trachea or to the presence of a bony labyrinth such as is found in certain male ducks. In those birds where nesting care is transferred to the male, the female may show a sex difference, as is seen in the tracheal sac of the Emu. In most birds where nesting duties are equally shared, such as the gulls and the cranes, there is no demonstrable sexual dimorphism.

The song of immature birds is usually quite different from that of the adult. In some cases the transition to adult song is not gradual but rather sudden and is often accompanied by a breaking of the voice. This corresponds with the time when the trachea and bronchi have attained their full length and when the tracheal, bronchial, and syringeal rings have become completely ossified. In most species adult song is not acquired until the second year. This is not true for canaries, for many a young canary has been known to have mastered the adult song. In the Crested Grebe the call produced during the first year comes from the vibration of the internal tympaniform membranes. Later this membrane gradually ossifies, and its duties are taken over by a more caudally placed interbronchial ring membrane.

The vocal accomplishments of the parrot are quite unusual. Its syrinx, too, is unique. To begin with, there is no tracheosternalis muscle. Neither is there a pessalus. The internal tympaniform membrane is incapable of vibrating. The external tympaniform membrane is located at the level of the bifurcation of the trachea. It is attached caudally to the first bronchial ring, and cranially to a semilunar cartilage which is free and capable of independent movement. Three pairs of specialized muscles (Fig. 4C) act on this apparatus. One muscle extends the whole length of the trachea to the hyoid bone; thus it is capable of varying the length of the trachea. A second bulges the external tympaniform membrane into the air passage. A third tenses the external tympaniform membrane itself. Thus its syrinx is quite different from that of other birds. But what makes it talk? Apparently most of its ability is on the mental side. Its voice range approximates that of the human voice. If, however, you will agree that an inherited pattern in the nervous system of the Mockingbird permits it to imitate the song of birds in its voice range, could not a similarly inherited pattern in the nervous system of the parrot allow it to imitate the voice of man?

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**TENTH ANNIVERSARY OF BECKHAM BIRD CLUB,
JANUARY 9, 1945**

Reported by THELMA GENTRY

In spite of bad weather, with streets and sidewalks as slippery as polished floors, the Beckham Bird Club celebrated its tenth birthday on January 9, 1945, with an interesting program and party in the Woman's Building on the University of Louisville campus. Forty-two members were present. Miss Louise Isfort reviewed several articles in the September, 1944, number of THE MIGRANT, which told of the discovery of the Chimney Swift's winter home. Miss Evelyn Schneider, our historian, then surveyed "Our Interesting Past."

Because Burt Monroe thought there was sufficient interest in ornithology here to start a Louisville chapter of the Kentucky Ornithological Society, a meeting was called on January 11, 1935, in the University of Louisville Library. There were thirty-two present. Colonel Lucien Beckner delivered an excellent talk on that occasion. Officers elected at that meeting were the following: President—Burt Monroe; Vice-President—Evelyn Schneider; Secretary—Mrs. Dorothy Hobson; Directors—Floyd Carpenter, Emilie Yunker, Harvey Lovell; Members of Committees—Colonel Beckner, P. A. Davies, Tom Wallace, and Mrs. Anne Stamm.

Two purposes in organizing, as expressed at that first meeting, were to stimulate interest in the study and conservation of birds and to strengthen the K. O. S. These we have kept in mind throughout the years, as a review of our activities by Miss Schneider showed. We have enlarged the membership by scheduling field trips and lectures to study birds, we have given talks before interested groups, and we have presented important bird lecturers to the public from time to time. To the K. O. S. we have contributed funds, articles for the WARBLER, and helped increase its membership. We have a small library built around Mr. C. W. Beckham's bird books, a collection of bird song recordings, a set of colored slides of all the common Kentucky birds, and—rather important—several government bonds.

For a number of years we have participated as a group in the nation-wide Christmas Bird Count conducted by the National Audubon Society. We have attended K. O. S. meetings at Mammoth Cave,

Franklin, Henderson, Paducah, Lexington, Natural Bridge, Sulphur Well, and Berea. Our members have brought us reports of birds seen on their travels—Colorado, Canada, Cornell University, Florida, Mt. Ranier, Maine, Audubon Natural Camps, T. O. S. Field Weeks, Dr. Wilson's famous week-ends at Bowling Green or Mammoth Cave, Wilson Club meetings, and A. O. U. meetings. In 1939 the Beckham Bird Club was host to the Wilson Club when it met in Louisville. We have participated for several years in the annual Kentucky Natural History and Wildlife Conference and in the Natural History Institute.

We haven't been entirely serious, either. The annual Cuckoo Party began as far back as 1937. In 1940, in celebrating our fifth anniversary, Mrs. Eugene Doelckner brought to the meeting a huge birthday cake beautifully iced with "Happy Birthday Beckham Bird Club" across it.

In the spring of 1938 we set up a Bluebird Housing Project. One evening we formed a production line and completed twenty-nine bird houses. On April 1, 1938, we had Dr. A. A. Allen, of Cornell University, for a lecture. This venture was such a success that we again invited Dr. Allen in 1943. In the winter of 1944-45 we have had a series of lectures with colored moving pictures presented by the National Audubon Society.

The presidents who have guided the Beckham Bird Club's activities through these years are 1. Burt Monroe, 2. Floyd Carpenter, 3. Mabel Slack, 4. Evelyn Schneider, 5. Floyd Carpenter, 6. Harvey Lovell, 7. William Clay, 8. Anne Stamm, 9. Esther Mason, and 10. Audrey Wright.

After Miss Schneider's talk, briefly summarized above, the committees under Miss Thelma Gentry and Mrs. Eugene Doelckner provided us with interesting bird games and delicious cookies and Russian tea. The two large birthday cakes were made by Mrs. Doelckner. The hero of the party was Mr. Otto Dietrich, who unasked and unnoticed, went to the kitchen and washed all the dishes. All evening remarks were overheard in which members told each other how glad they were that they had joined the Beckham Bird Club and shared in its activities.

TO A WOOD THRUSH

By SUE WYATT SEMPLE

Somewhat of a recluse, and sweetly shy,
This rich-brown songster has a white eye ring;
Heart-shapes of darker brown identify
His throat, his breast, and sides below each wing.
He likes dense woodlands frilled with scented ferns,
Those deep, cool forest solitudes of rest
Where not a ray of noonday sunlight burns,
To lift his heavenly voice and h'de his nest.
His bell-like notes are penetrative, pure,
Vibrating keenly just before it rains;
His peals so exquisite prove his mate's lure,
For love alone inspires his finest strains.
He brings nostalgic memories to one's mind
Of grape-vine swings where youth was left behind.

SOME MORE 1944 NOTES—On April 13, 1944, I studied at close range for half an hour a Pigeon Hawk, on the Hoover farm, south of Bowling Green. It was positively tame as compared with any other hawk I have been around. My only other Kentucky records for the species are as follows: November 19, 1938, at the McElroy farm and October 3, 1942, on the Boadley Davenport Farm. I saw the skin that Virgil King had of a bird killed in Henderson County in 1937. Records of this species are very rare in the state.

While I was camping alone at Mammoth Cave in the late summer of 1944, a Wood Pewee often serenaded me late in the afternoon. On September 5 one introduced into his song an extended phrase, "Pee-a-wee-a-wee." He would not always give this note but would add it about every third time. Otherwise his song was natural, the little four-lined stanza that he does so many times but always so meticulously.

On April 2, 1944, in the little holly-shaded gorge between Potato Hill, just outside the Mammoth Cave National Park, and Indian Hill, just inside, I saw and heard the two water-thrushes, the first opportunity I have ever had to compare their songs. The Northern Water-thrush is very rare here in migrations, but the Louisiana nests along our small streams. It was a cold, raw day when I heard them, but they sang wildly, their notes blending with the sound of many little waterfalls.

Even trained ears had better be wary about bird songs. On July 1, 1944, I distinctly heard the "Kili, kili" notes of the Sparrow Hawk. I was unable to locate the bird but did see a Yellow-breasted Chat in the tree where the sound came from. By close watching I discovered that the Chat was imitating the hawk. The hawk note came at the same place in the elaborate series of squawks and whistles; I heard it thirty or more times while I was within hearing distance. Several times in the late summer of 1944 I heard the note of the Upland Plover, a sound that a bird student is not likely to forget, once he has learned it. It seemed strange to be hearing this bird over the town, for I associate it with alfalfa fields in spring and late summer. At our August commencement at Western I heard the plover again; right in the midst of the invocation. I opened my eyes and discovered a Starling in the very act of imitating this rather rare water bird. Where could it have heard the original, at least enough to give such a remarkable imitation? I was nearly as much surprised as I was when I heard a Starling imitate a Nighthawk when snow was on the ground. Moral: Do not be too sure about a bird note as long as Starlings and Chats—not to mention Mockingbirds, Catbirds, and Brown Thrashers—are around!

On December 28, 1944, Mr. Ottis Willoughby, our Warren County taxidermist who prepared the skins for the Kentucky Building at Western, brought to town a dead Golden Eagle, which had been killed by a farm boy out near Jackson's Bridge across Gasper River. Professor L. Y. Lancaster and I examined it for the feathers that extended to the toes, as well as for other markings. My only previous records for the species in this county are April, 1919, when one was kept in a cage during a Red Cross drive; and October 14, 1932, when one was killed near the mouth of Barren River.

In 1943 I rejoiced at finding almost daily a Hairy Woodpecker on our campsite. In mid-April, 1944, after being absent for some

weeks, it appeared again and was seen nearly every time I walked to or from my classrooms. It did not go away to the woods in the winter of 1944-45 but was seen and heard just as it was in the summer. This species has been so rare throughout my years of bird study that I have sometimes gone whole months without finding one, even in my most extended walks and camps.

GORDON WILSON, Bowling Green.

A BIG SPRING LIST, A CHALLENGE

The editor wishes to challenge all of you to a big spring list, not that any one will get a prize in cash but that all of us may strain ourselves, if need be, to run up a large list, one that will remain as a landmark in our spring bird study. Naturally, this list will come in late April or early May. Send in your largest list to the editor as soon as the migration season is over. All such lists will be published in our summer issue, in tabulated form, just like our Christmas Bird Count. Confine it to one day or a week-end in which you remained out in the bird territory all the time. This challenge ought to cause several of you to get out for a week-end camp to take the place of our annual spring meeting.

ORNITHOLOGICAL NEWS

Mr. and Mrs. F. Everett Frei, after being out of the state for many months working in an airplane plant in Evansville, Indiana, have come back to Kentucky, and are making their home at Horse Cave. Mrs. Frei has already won her spurs there by speaking before the Horse Cave Woman's Club, on birds, of course.

Recently a committee has been appointed to prepare a volume dealing with the resources of Kentucky. This project is being sponsored jointly by Mr. Harold A. Browning, Commissioner of Conservation of the state, and Mr. John Fred Williams, State Superintendent of Public Instruction. A large volume will be prepared and also a reading book adapted to sixth or seventh grade, so that everybody, child or adult, can have an opportunity to become acquainted with the state and its resources. On the important central committee the following K. O. S. members are serving: Mrs. J. Kidwell Grannis, Mr. Tom Wallace, and Dr. G. D. Pennebaker. On sub-committees are Dr. Gordon Wilson, Dr. Harvey B. Lovell, Miss Lucy Furman, Mrs. Z. C. Layson, Mrs. Alice Moore, and Miss Beulah Marsh.

Dr. Harvey B. Lovell has recently been appointed by our president, Major Victor K. Dodge, as a member of the Committee on Affiliated Societies of the Wilson Ornithological Club.

The K. O. S. has recently issued, through the efforts of Mr. Leonard Brecher and Dr. Lovell, a record card, "Field List of Kentucky Birds," which can be obtained from our secretary-treasurer, at the following prices: 100 for \$1.25; 50 for 75 cents; 25 for 40 cents. No orders can be filled for less than 25, though members who can contact our secretary can obtain smaller numbers at two cents a

card. This card is an excellent and compact method of keeping complete field notes and should be used extensively by our members.

So many new members have come in and so many requests for back numbers that with this issue, we are printing 300 copies of the WARBLER. Even after having 250 printed for the last issue it was necessary for us to have 20 more run off to take care of the growing sale of extras. The way we have been able to grow in membership right through the war deserves a compliment from somebody; the editor takes this duty upon himself gladly, for a lot of people have been busy keeping up our society membership and morale.

FRANKLIN'S GULL ON OHIO RIVER AT LOUISVILLE

On November 11, 1943, we observed a flock of strange gulls between the Pennsylvania Railroad and Municipal Bridges on the Ohio River above the hydro-electric dam. With 8x4 mm. field glasses we were able to see clearly that their wing tips were black, tipped with white, which, according to Peterson's GUIDE, is diagnostic for Franklin's Gull (*Larus pipixcan*), whereas Bonaparte's Gull has the tips of the wings all black. As the birds circled low over our heads, at the end of Fourth Street, we were able also to observe the black spot around the eye and the greyish half-hood over the back of the head. All three of the main plumages were represented: immature birds in their first fall plumage with a subterminal black band across the tail, adults in winter plumage without the black band and with the greyish band on the back of the head, and at least two individuals still in breeding plumage with a black head. The presence of the last-named marking is surprising, since winter plumage is supposed to be acquired in October. There were at least twelve Franklin's Gulls in the flock and probably twenty. On November 14 we saw a single adult Franklin's Gull with the black head swimming near the wharf. On November 19 several of the birds were again seen, but they were feeding near the middle of the river. On November 21 they could not be found. The only published record for Franklin's Gull in Kentucky is that of Pindar for Fulton County, down below the mouth of the Ohio River [AUK, VI (1889), and WILSON BULLETIN, XXXVII (1925)]. This gull is a bird of the interior, particularly the prairie regions, breeding from southern Minnesota westward to Utah and wintering from Louisiana and Texas southward to Patagonia and Chile. It has been reported as an accidental visitor in Illinois, Michigan, Ohio, and Massachusetts. Since its regular route of migration is just west of Kentucky, it seems probable that wandering flocks visit western Kentucky and may occasionally wander up the Ohio River valley, as in the present case.

—Harvey B. Lovell and Floyd S. Carpenter, Louisville.

KENTUCKY ACADEMY OF SCIENCE NOT TO MEET IN 1945

The Kentucky Academy of Science was to have been held in Louisville on April 27 and 28 this year, and plans had been made for a good program. The War Committee on Conventions of the O. D. T. has denied permission to hold the sessions because of transportation difficulties. This will be a great disappointment to many of our members who are also members of the Academy.

FISH AND WILDLIFE SERVICE STUDY EFFECTS OF DDT

The organic chemical DDT has been used extensively by the Armed Forces to control insects. The chemical has been so successful that interest has arisen in its possible use for the control of other insects besides those causing sickness or discomfort among our service men. Up until now no definite knowledge exists as to possible effects on birds, for instance, should DDT be used on a large scale. This spring DDT will be applied experimentally by the Bureau of Entomology and Plant Quarantine of the Department of Agriculture to several forest areas, chiefly in the Northeast. Fish and Wildlife Service personnel will conduct detailed investigations on these sprayed areas during the spring in cooperation with the Bureau of Entomology and Plant Quarantine. Thus far preliminary studies seem to indicate that few, if any, birds and animals are likely to be killed by DDT itself, though indirect harm may come through reduction in insect-food supplies, especially when applications are made shortly before or during the nesting season. Many experiments are in progress on the effect of the poison when taken internally by Bobwhites, Mallards, various small rodents, mice, rabbits, fish, and other animals. The results of these experiments will indicate whether DDT for the control of pest insects is hazardous to wildlife.

—Abstract of article distributed by Ira N. Gabrielson, Director of Fish and Wildlife Service, United States Department of Interior.

ECHO FROM MISS SCHNEIDER'S CHUCK-WILL'S-WIDOW STUDY

Here is a letter from Dr. Alexander Wetmore, Acting Secretary of the Smithsonian Institution, Washington, D. C., that shows how our articles are read and appreciated:

Washington, D. C., August 30, 1944

Miss Evelyn Schneider
2237 Alta Avenue
Louisville, Kentucky

My Dear Miss Schneider:

I have greatly enjoyed reading your account of the Chuck-will's-widow in the recent separate that has just come to me in the mail. This is a fine bird and one that has always interested me. The facts that you bring out on northward extension of range are highly interesting and coincide with some observations that I have made during the last fifteen or twenty years here near Washington.

Years ago the species was practically unknown, but now I find it fairly common in a considerable area in southern Maryland. I have even heard it fairly well north along Chesapeake Bay. Back in the days when we were able to travel around in automobiles in field work I could always find them along the roads at night in the summer months.

You have assembled a fine lot of records for your state.

Sincerely yours,

Alexander Wetmore, Acting Secretary.